



# SAGE III ISS

## Utilization of Disturbance Monitoring Package in Data Products

SAGE III/ISS Science Team Meeting at NASA LaRC

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13 October 2022

Utilization of DMP  
in Data Products

Charles Hill

DMP Overview

What is it?  
Where is it?  
Daily Observations  
How are we using it?

Transmission

Aerosol Products

384 nm Aerosol  
676 nm Aerosol  
756 nm Aerosol  
1021 nm Aerosol

Species

O<sub>3</sub>  
NO<sub>2</sub>  
H<sub>2</sub>O  
Products Summary

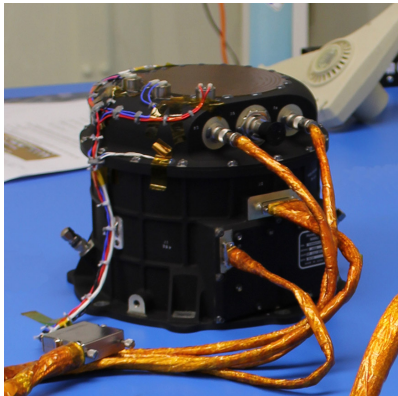
What is next?

Questions

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# Disturbance Monitoring Package (DMP)



- ▶ The DMP is a Honeywell Miniature Inertial Measurement Unit comprised of three orthogonal ring laser gyros to measure angular rates in three orthogonal axes.
- ▶ The SAGE III science retrieval algorithm requires precise pointing knowledge with respect to Earth and the radiant target.
- ▶ The DMP's primary requirement was to flag periods when vibration conditions can negatively impact the science data product.

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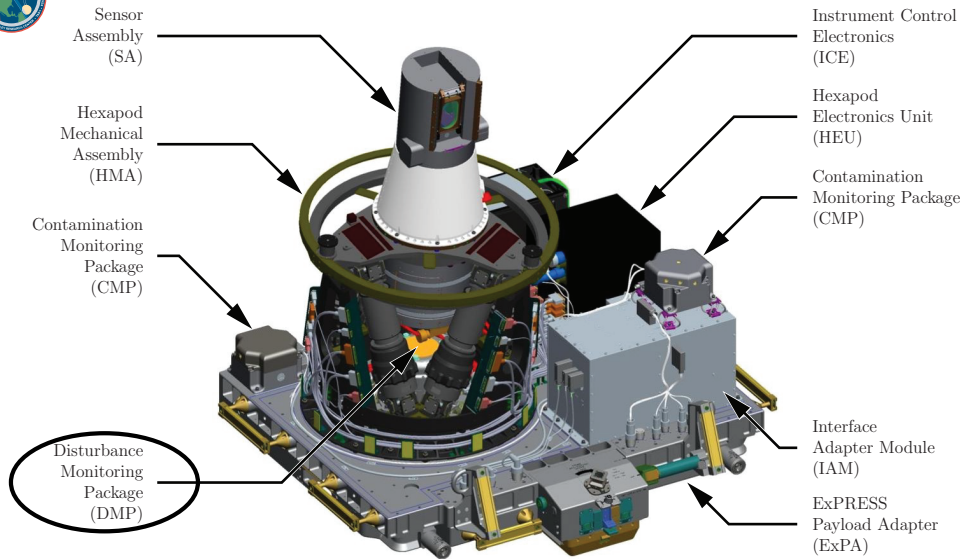
Products Summary

What is next?

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# SAGE III ISS



## Utilization of DMP in Data Products

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### DMP Overview

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#### Species

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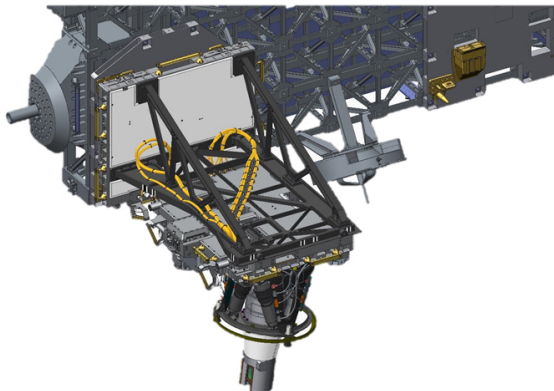
Products Summary

### What is next?

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# Payload Overview



The Stratospheric Aerosol and Gas Experiment (SAGE) III is an external payload on the International Space Station (ISS) launched on SpaceX CRS-10 on 19 February 2017 and robotically installed on ExPRESS Logistics Carrier-4 (ELC-4). First light was acquired on 17 March 2017.

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### Species

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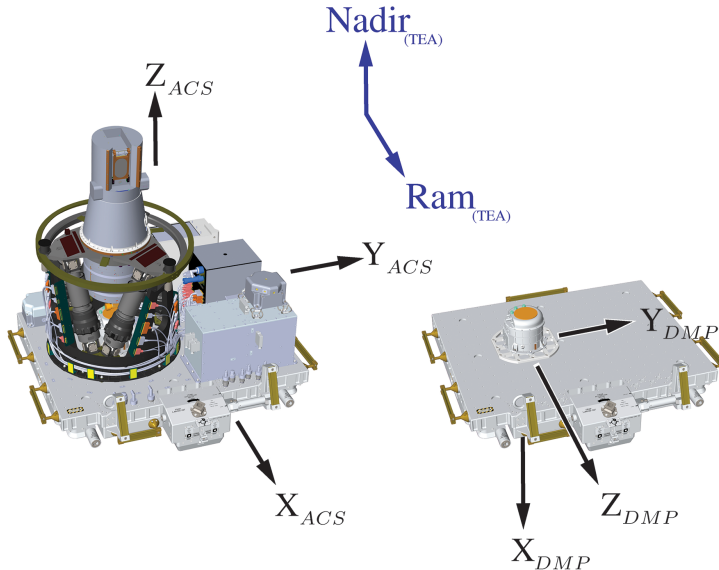
Products Summary

What is next?

Questions



# Payload Axes



## Utilization of DMP in Data Products

Charles Hill

### DMP Overview

What is it?

Where is it?

Daily Observations

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### Transmission

### Aerosol Products

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1021 nm Aerosol

### Species

$O_3$

$NO_2$

$H_2O$

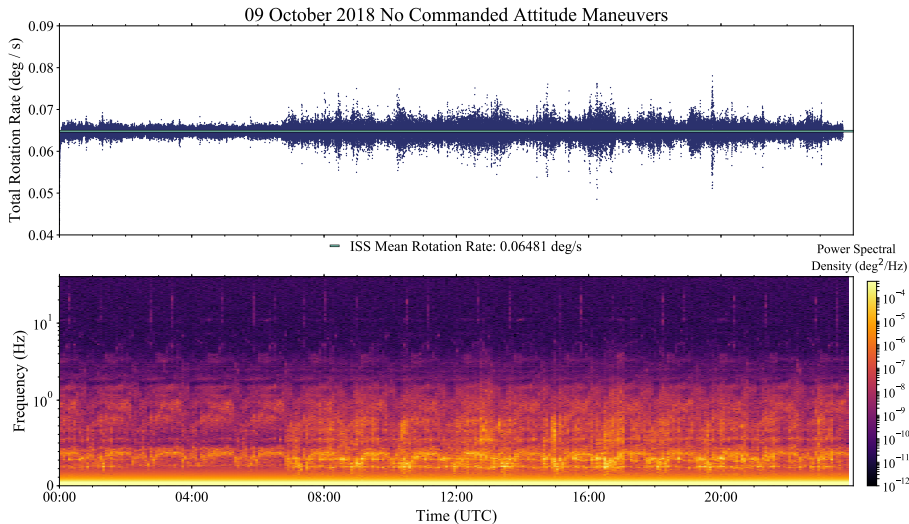
Products Summary

### What is next?

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# Quiescent Day as Observed from ELC-4



## Utilization of DMP in Data Products

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### Transmission

#### Aerosol Products

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#### Species

O<sub>3</sub>

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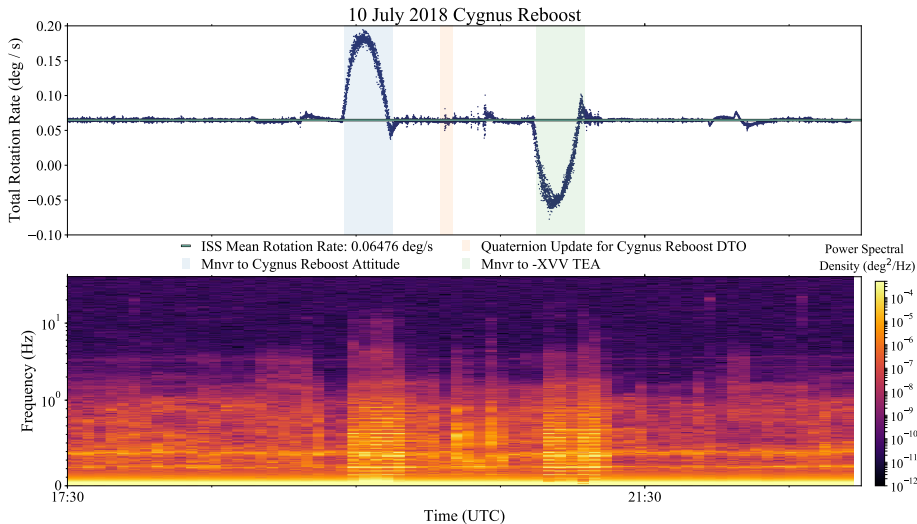
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# Large Shock from Reboost Observed from ELC-4



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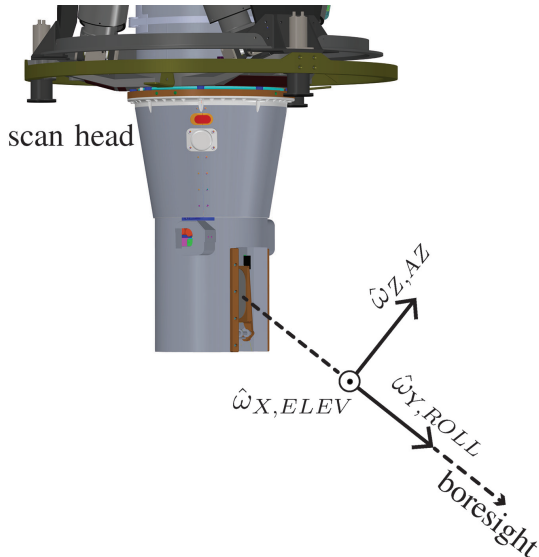
Products Summary

### What is next?

### Questions



# SAGE III Boresight Coordinates



Utilization of DMP  
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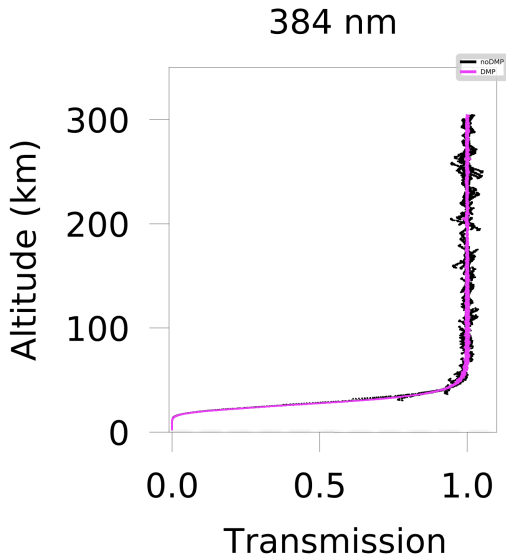
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# Elevation Correction Improves Transmission Noise



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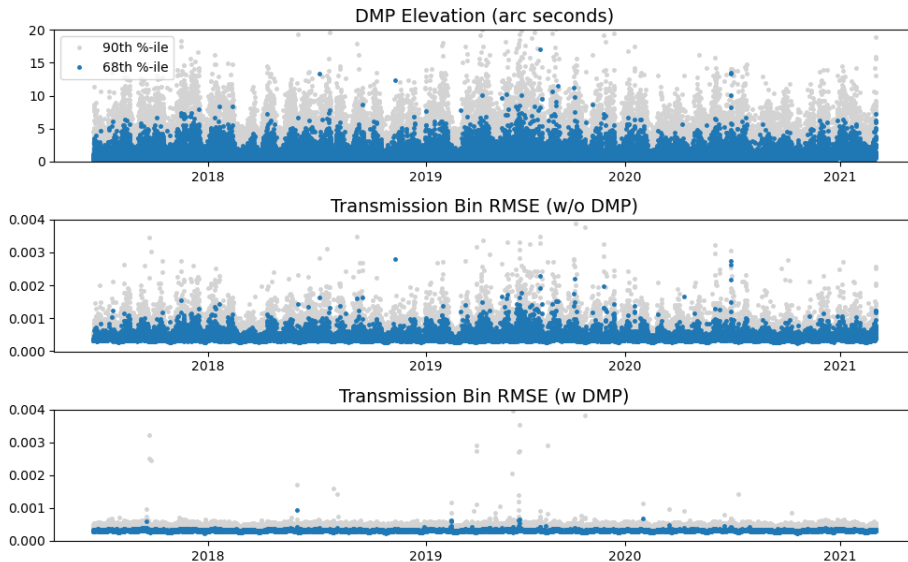
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# Elevation Correction Improves Transmission Noise



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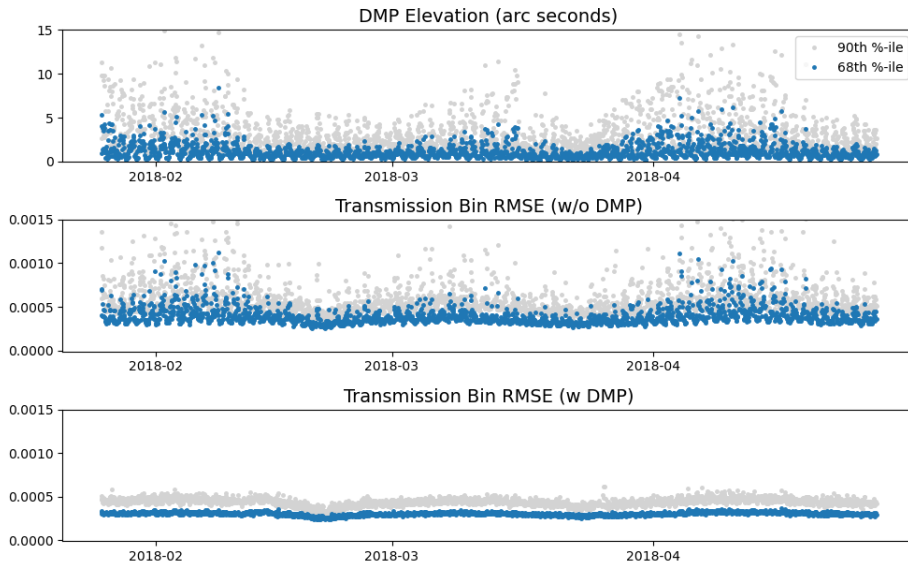
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# Elevation Correction Improves Transmission Noise



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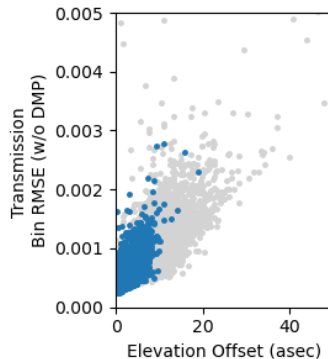
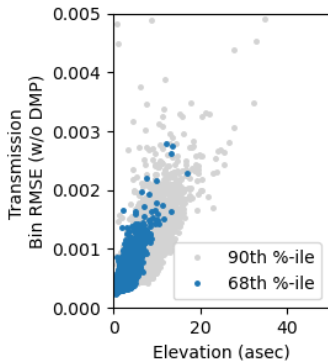
### Questions



# Correlation With Elevation Vibration



DMP Correlation  
# Events: 30082



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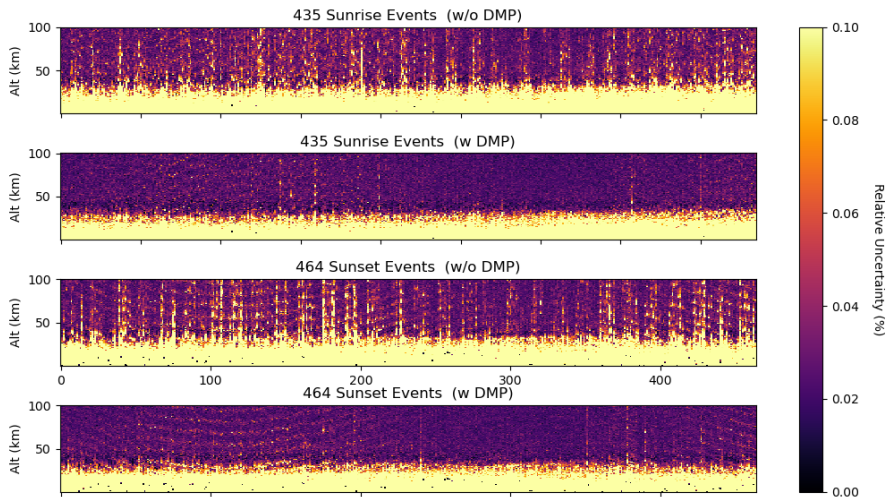
What is next?

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## Transmission Uncertainty April 2018 PG 86



### Utilization of DMP in Data Products

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#### Transmission

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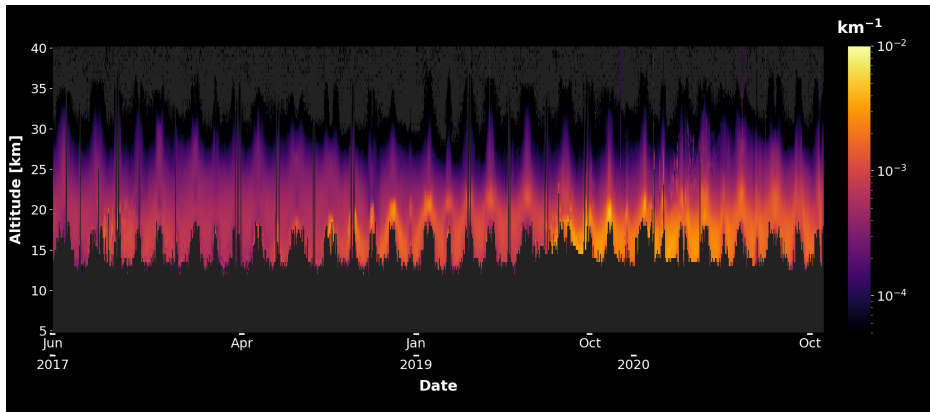
- O<sub>3</sub>
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# 384 nm Aerosol NO DMP Correction



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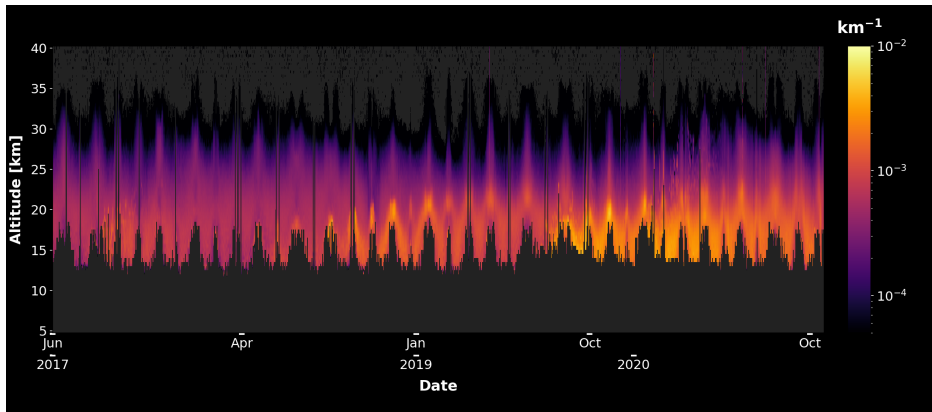
- O<sub>3</sub>
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# 384 nm Aerosol With DMP Correction



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### Transmission

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### Species

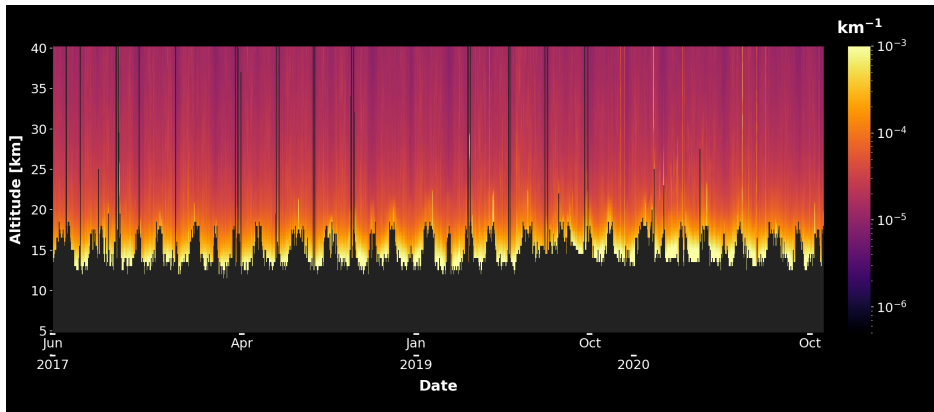
- O<sub>3</sub>
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### Questions



# 384 nm Aerosol Uncertainty NO DMP Correction



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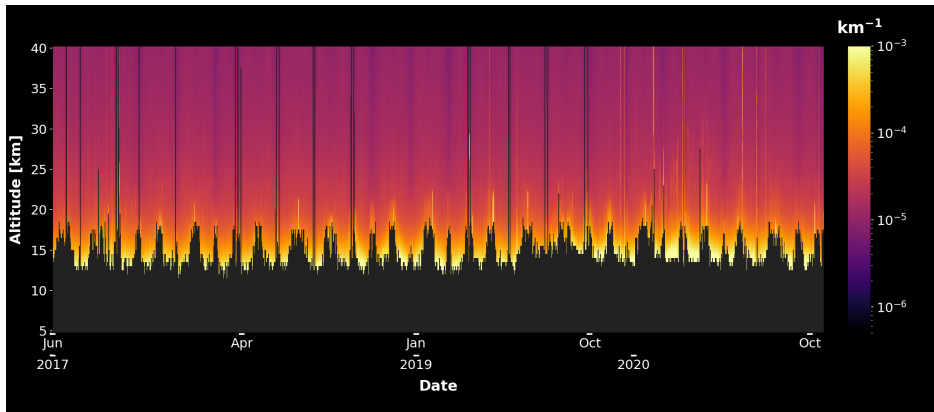
Products Summary

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### Questions



# 384 nm Aerosol Uncertainty With DMP Correction



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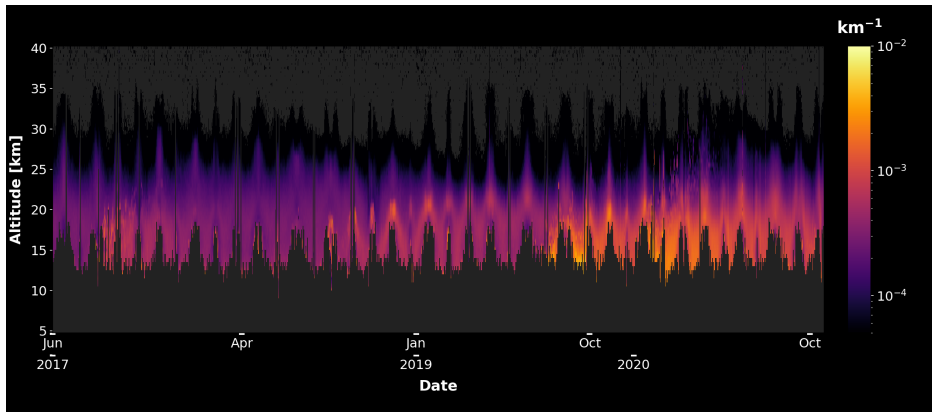
- O<sub>3</sub>
- NO<sub>2</sub>
- H<sub>2</sub>O
- Products Summary

#### What is next?

#### Questions



# 676 nm Aerosol NO DMP Correction



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### DMP Overview

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### Transmission

### Aerosol Products

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### Species

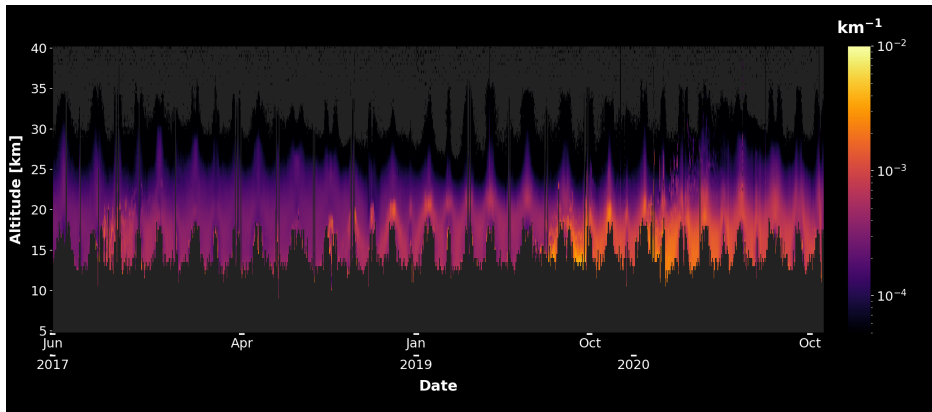
- O<sub>3</sub>
- NO<sub>2</sub>
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### What is next?

### Questions



# 676 nm Aerosol With DMP Correction



## Utilization of DMP in Data Products

Charles Hill

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- What is it?
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### Transmission

### Aerosol Products

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### Species

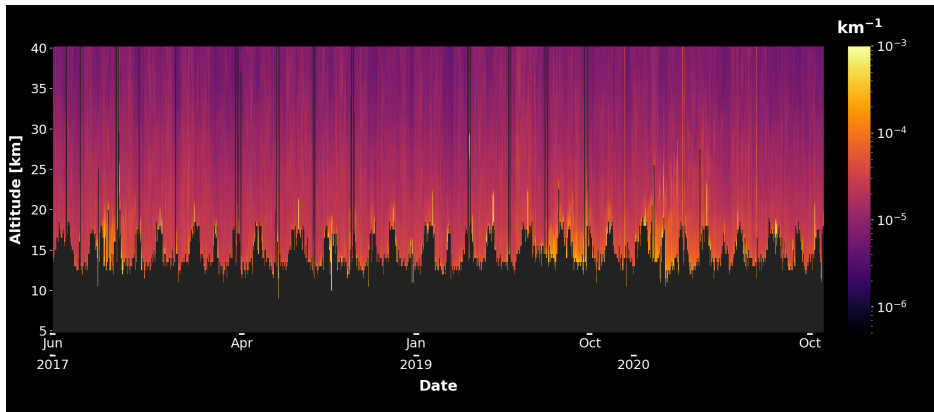
- O<sub>3</sub>
- NO<sub>2</sub>
- H<sub>2</sub>O
- Products Summary

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### Questions



# 676 nm Aerosol Uncertainty NO DMP Correction



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### Transmission

#### Aerosol Products

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### Species

- O<sub>3</sub>
- NO<sub>2</sub>
- H<sub>2</sub>O
- Products Summary

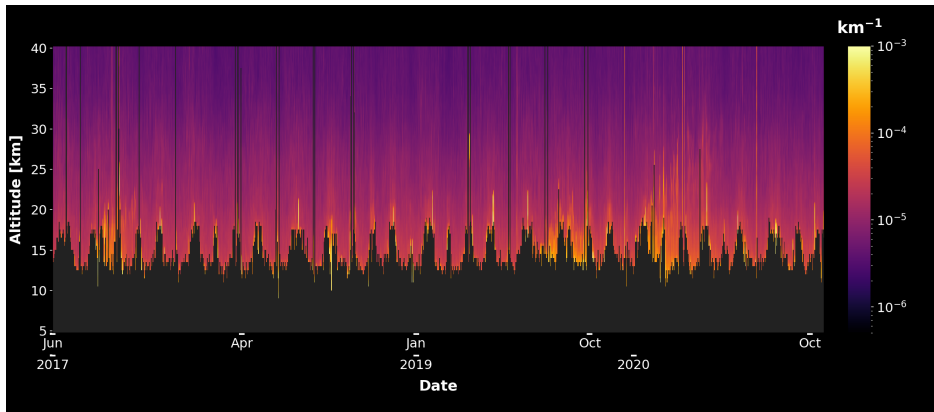
### What is next?

### Questions





# 676 nm Aerosol Uncertainty With DMP Correction



## Utilization of DMP in Data Products

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### Transmission

#### Aerosol Products

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- 676 nm Aerosol
- 756 nm Aerosol
- 1021 nm Aerosol

### Species

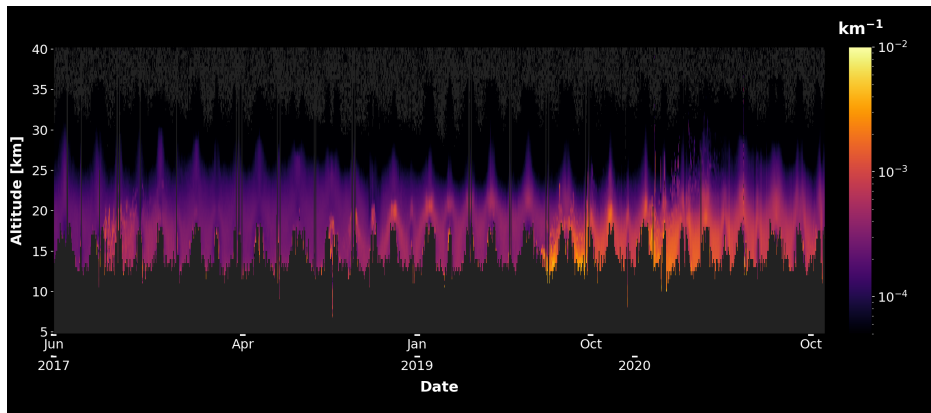
- O<sub>3</sub>
- NO<sub>2</sub>
- H<sub>2</sub>O
- Products Summary

### What is next?

### Questions



# 756 nm Aerosol NO DMP Correction



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### Transmission

#### Aerosol Products

- 384 nm Aerosol
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- 756 nm Aerosol
- 1021 nm Aerosol

### Species

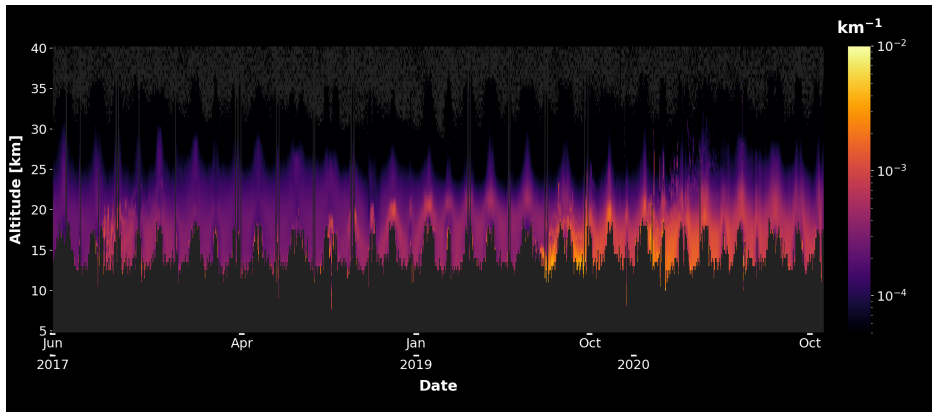
- O<sub>3</sub>
- NO<sub>2</sub>
- H<sub>2</sub>O
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# 756 nm Aerosol With DMP Correction



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### Transmission

### Aerosol Products

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- 676 nm Aerosol
- 756 nm Aerosol
- 1021 nm Aerosol

### Species

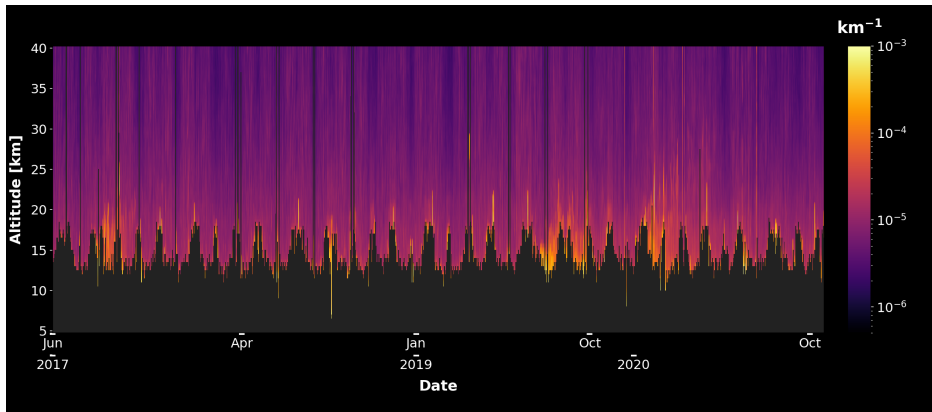
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- NO<sub>2</sub>
- H<sub>2</sub>O
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# 756 nm Aerosol Uncertainty NO DMP Correction



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### Transmission

#### Aerosol Products

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- 756 nm Aerosol
- 1021 nm Aerosol

### Species

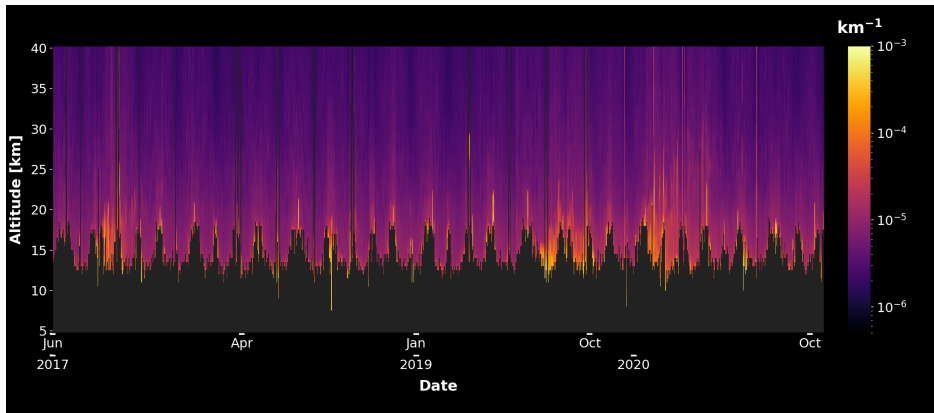
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- NO<sub>2</sub>
- H<sub>2</sub>O
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### What is next?

### Questions



# 756 nm Aerosol Uncertainty With DMP Correction



## Utilization of DMP in Data Products

Charles Hill

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- What is it?
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### Transmission

#### Aerosol Products

- 384 nm Aerosol
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- 756 nm Aerosol**
- 1021 nm Aerosol

### Species

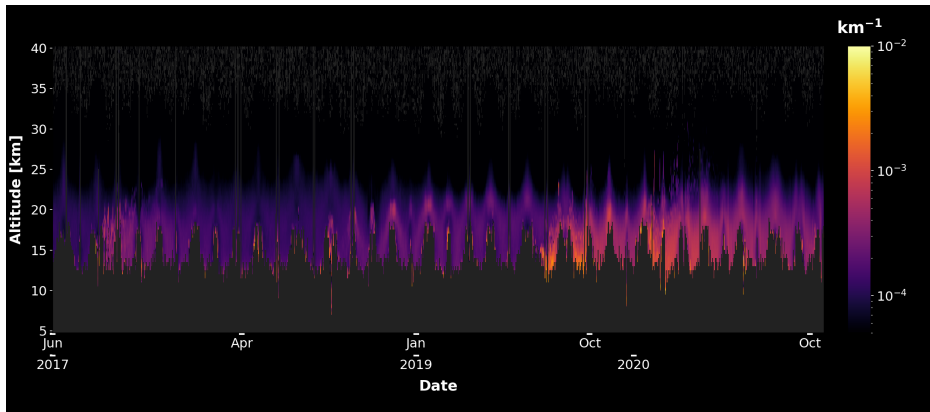
- O<sub>3</sub>
- NO<sub>2</sub>
- H<sub>2</sub>O
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### What is next?

### Questions



# 1021 nm Aerosol NO DMP Correction



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### Transmission

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#### Species

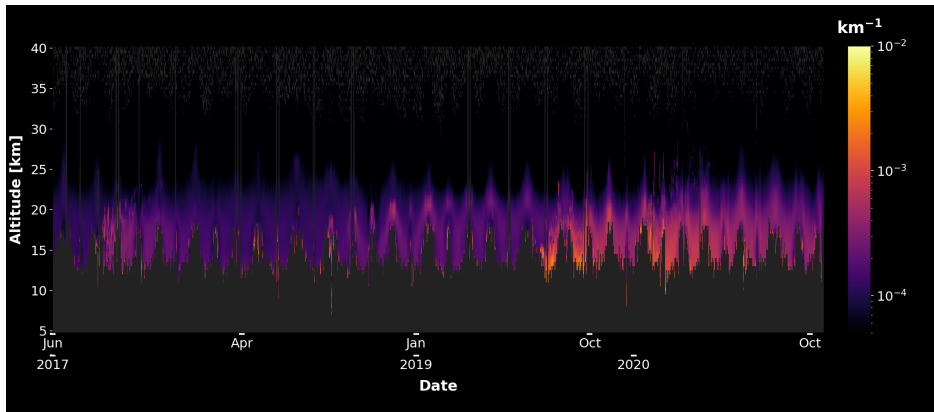
- O<sub>3</sub>
- NO<sub>2</sub>
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#### What is next?

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# 1021 nm Aerosol With DMP Correction



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### Transmission

### Aerosol Products

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### Species

O<sub>3</sub>

NO<sub>2</sub>

H<sub>2</sub>O

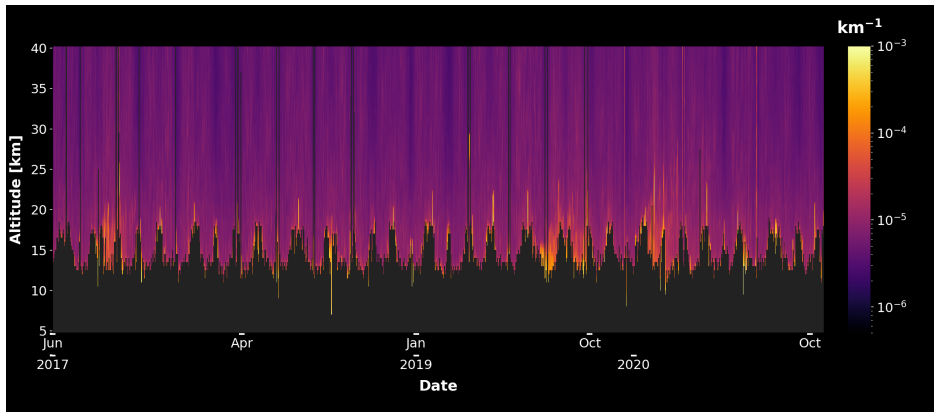
Products Summary

### What is next?

### Questions



# 1021 nm Aerosol Uncertainty NO DMP Correction



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O<sub>3</sub>  
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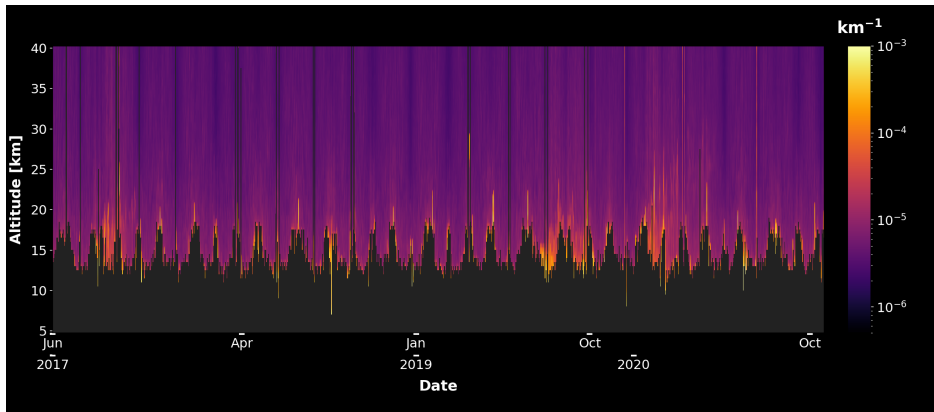
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# 1021 nm Aerosol Uncertainty With DMP Correction



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### Species

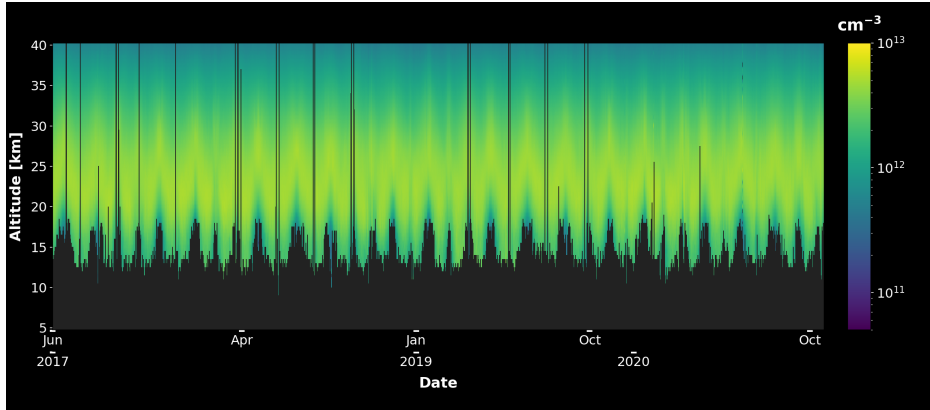
- O<sub>3</sub>
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# O<sub>3</sub> Product NO DMP Correction



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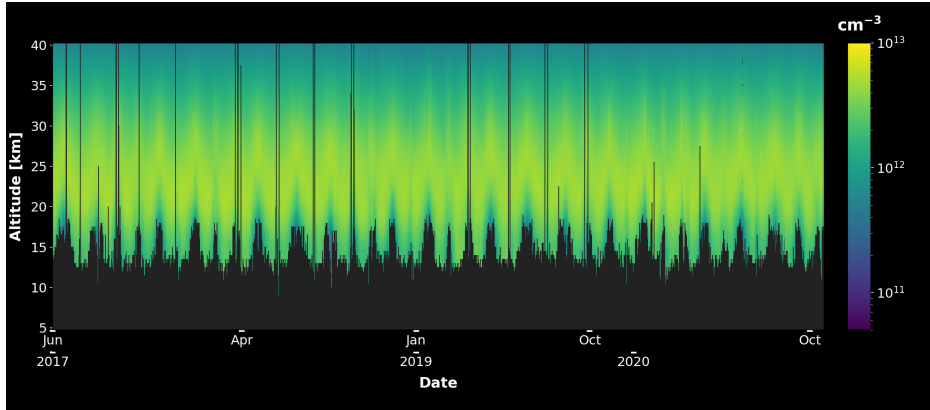
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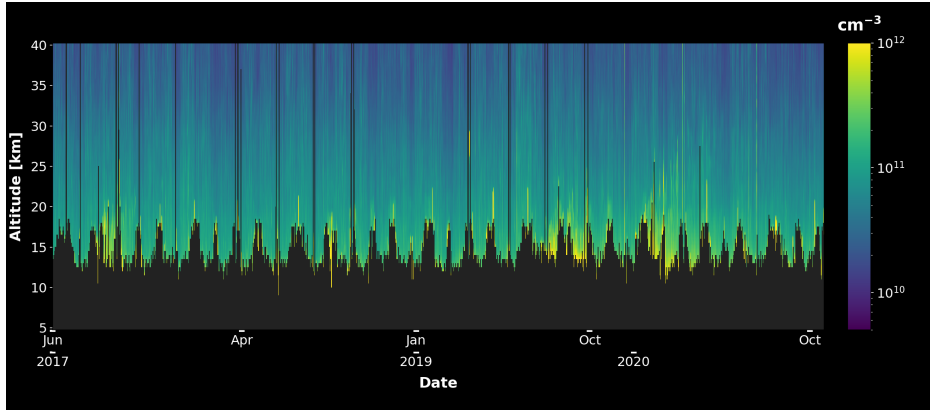
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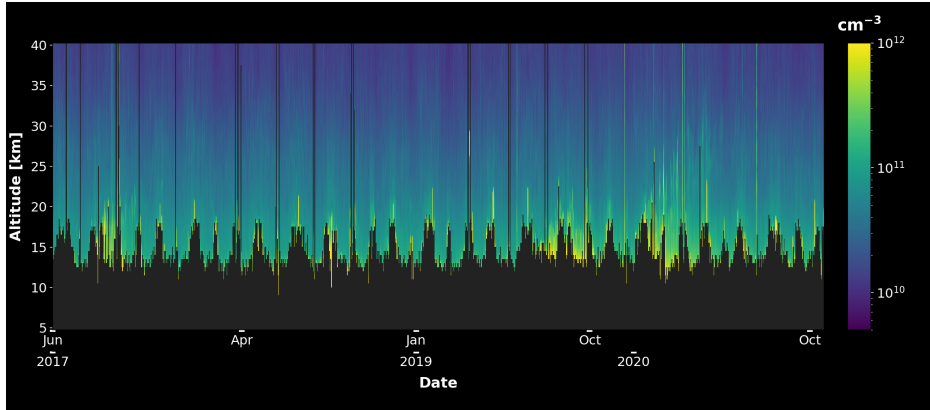
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Products Summary

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# O<sub>3</sub> Uncertainty With DMP Correction



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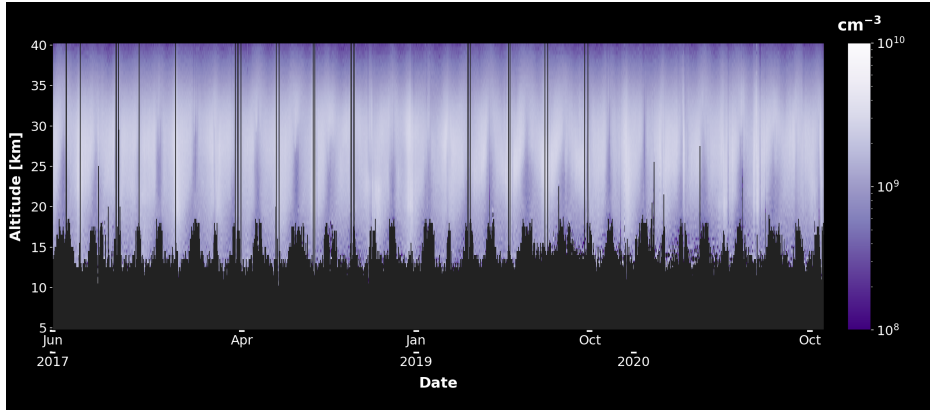
### Species

- O<sub>3</sub>
- NO<sub>2</sub>
- H<sub>2</sub>O
- Products Summary

### What is next?



# NO<sub>2</sub> Product NO DMP Correction



Utilization of DMP  
in Data Products

Charles Hill

## DMP Overview

- What is it?
- Where is it?
- Daily Observations
- How are we using it?

## Transmission

## Aerosol Products

- 384 nm Aerosol
- 676 nm Aerosol
- 756 nm Aerosol
- 1021 nm Aerosol

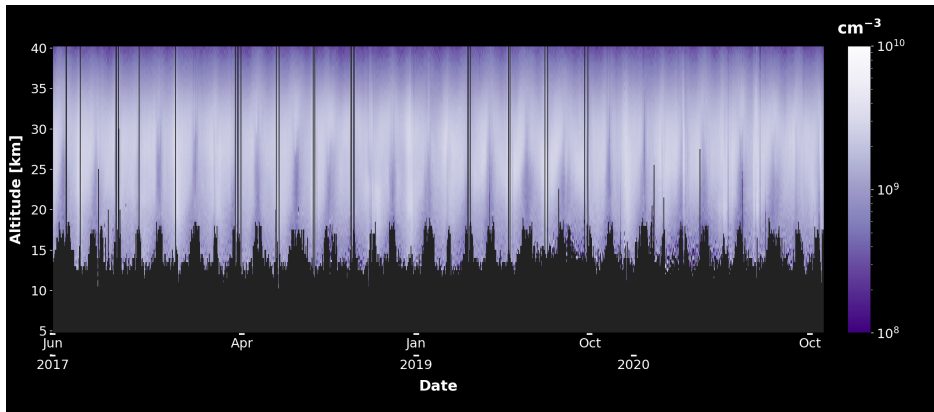
## Species

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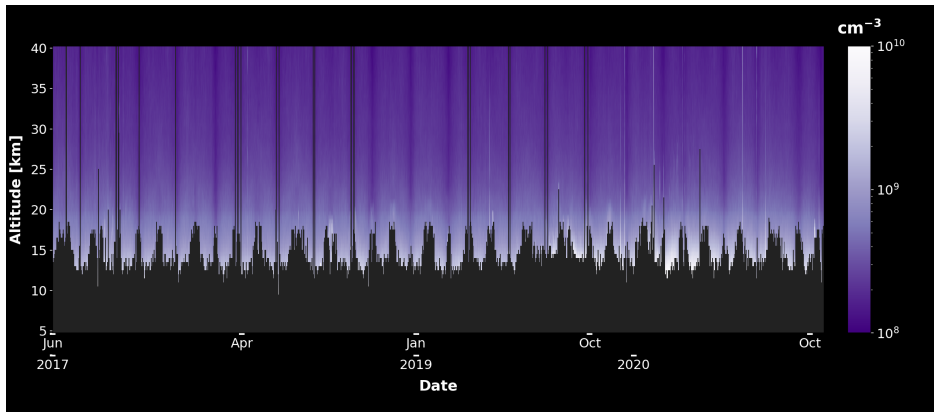
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### Questions



# NO<sub>2</sub> Uncertainty NO DMP Correction



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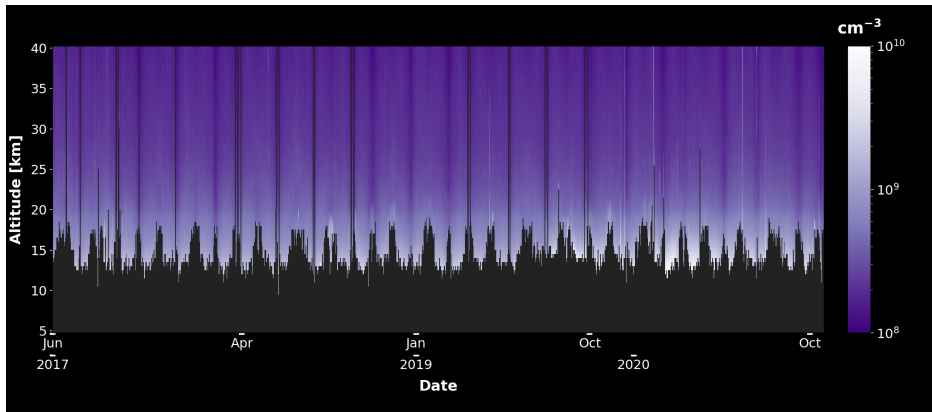
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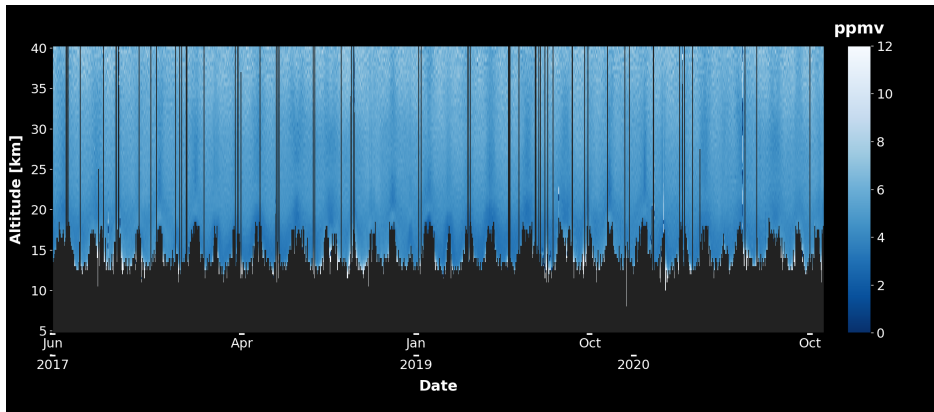
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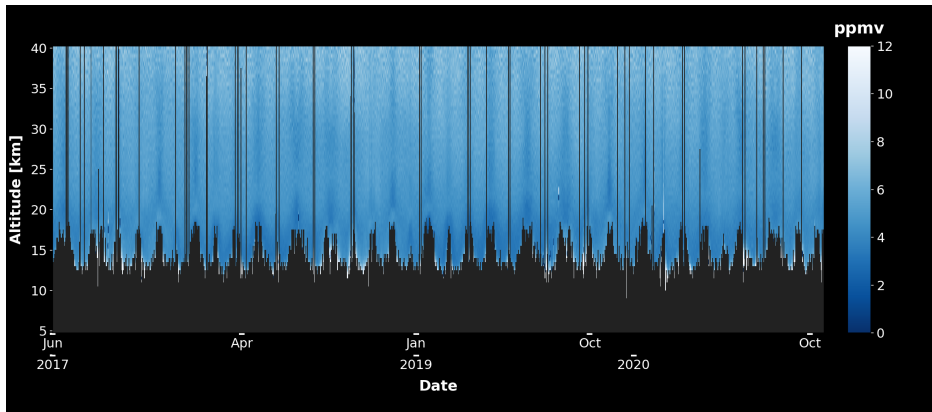
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#### Aerosol Products

384 nm Aerosol

676 nm Aerosol

756 nm Aerosol

1021 nm Aerosol

### Species

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NO<sub>2</sub>

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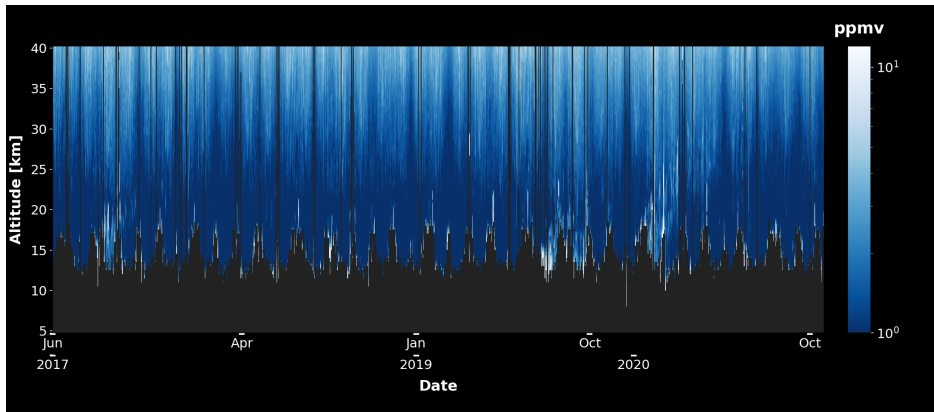
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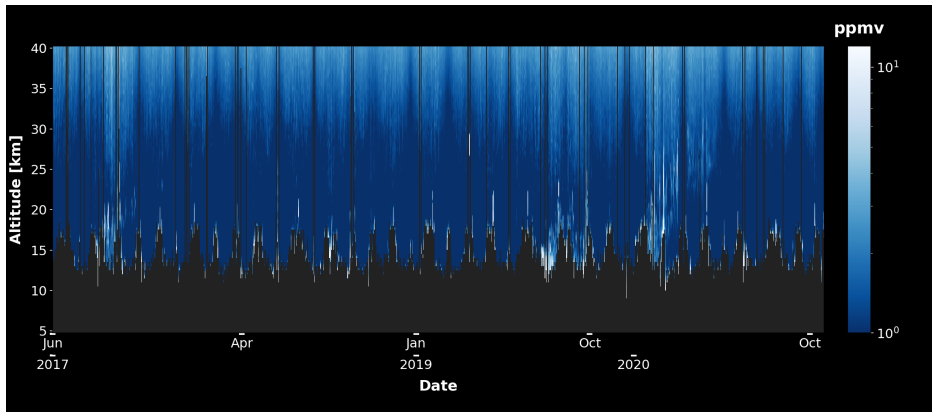
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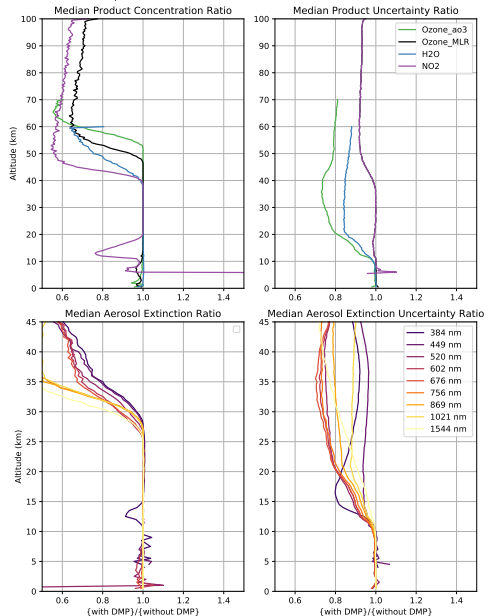
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Products Summary

### What is next?

### Questions



# Disturbance Monitoring Package (DMP)



What is next for the DMP Team?

- ▶ Submit a paper with details about the DMP correction to the SAGE III product
- ▶ Release a DMP-corrected version of the SAGE III product
- ▶ Comparisons with ISS LVLH attitude quaternion time series to assess truss deflections
- ▶ Absolute attitude product
  - Improved latitude/longitude/altitude registration for limb scattering measurements by implementing the SAGE III attitude Kalman Filter
  - Payload vibration environment at ELC-4 beneficial to ISSP and external payload community



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Products Summary

What is next?

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Questions?